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ABSTRACT

Agricultural engineers have been working for a number of years with colleges and universities in many developing countries to improve their agriculture. Much of the activity in university development assistance has been taken over the last 20 years. The greatest portion of the support has come from USAID. Among the common problems facing the programs were: (1) the method of financing on a year-to-year basis; and (2) teaching, research, and extension were rarely under one administrative unit. The first official agreement covering a United States sponsored university contract was signed in 1952. During the next 20 years, six American universities became involved. By 1972, India had established nine new agricultural universities patterned after our land-grant institutions. The program was phased out during 1972 and 1973 at the request of the Indian government. The overall objective of the United States university contract program was to help India develop state agricultural universities with colleges of agriculture, veterinary medicine, agricultural engineering, home science, and basic sciences and humanities. Insight is given as to how a College of Agricultural Engineering was established. (LS)

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# ENGINEERING EDUCATION PROJECTS FOR IMPROVING AGRICULTURE IN DEVELOPING COUNTRIES

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ENGINEERING EDUCATION PROJECTS

FOR

IMPROVING AGRICULTURE IN DEVELOPING COUNTRIES

It is generally recognized that increasing food production is a most critical need in many of the developing countries at this time. Engineers, especially agricultural engineers, have recognized this problem for some time and have been working for a number of years with colleges and universities in many countries to improve their agriculture.

Much of the activity in university development assistance has taken place over the last twenty years. The greatest portion of the support has come from USAID. However, university contract programs over the years have used less than one percent of the total government foreign aid funding. To supplement this, there has also been substantial support from foundations, especially from the Ford and Rockefeller Foundations.

In most countries, to move from their traditional agriculture to higher levels of production requires many more people who can supply the necessary technical information and services. The basic services needed are applied research, extension programs for farmers, and teaching programs soundly based on science and scholarship, but above all, practically oriented to local problems.

Anyone going overseas to one of the developing countries to work on agriculture can expect to get involved in equipment development. In some areas where the field work is still done primarily with hand tools,

the task might be to design improved tools of this type, preferably those that can be made locally. In other cases, the great need is to design better animal-drawn equipment, whether it is for bullocks, carabao, or camels. We can expect that work animals will be the principal source of power in many parts of the world for years to come. But in other areas and especially for certain crops, tractors are coming in rapidly right along side where animal power predominates.

Improved mechanical equipment is not only needed for field operations, but also for pumping water and for drying, cleaning and storing many seed and food crops.

The demand for mechanization is coming in even where there is apparently much unemployment in the country as a whole. For example, several states in India have requested and have had men on foreign assignments work exclusively on mechanization. Some people have asked, "Why does India want to develop mechanization when they already have a great surplus of labor?" The answer is that mechanization is needed primarily to increase production, not as a means of reducing labor.

With present primitive methods of land preparation, they often don't get their crops in on time. At the other end of the season, they need better equipment to harvest the crops when ready. There are also other applications for mechanization --

(1) To get the most from the improved seed that is being introduced, they must have better planters.

(2) To use fertilizer to the best advantage, it must be placed in the ground properly in the correct relation to the seed.

(3) To control insects and plant diseases requires mechanical sprayers and dusters which generally are not now available.

(4) To lift water from wells takes modern pumping equipment and power which is not generally used.

These are just a few of the examples where mechanization is needed for the increased food production.

It has been reported that during the fifteen-year period from 1953 to 1968, about a thousand faculty members from 35 United States universities participated in overseas assignments. I am sure that the number has increased substantially since then.

Some programs have met with a great deal more success than others. In some cases we probably expected too much too soon. Building viable institutions to better serve agriculture in developing countries, many of which are politically and economically unstable, is often a slow process, and results should be measured in decades rather than in years.

What an individual going overseas can accomplish is often controlled by factors other than technical. In a broad sense, it is the culture that he will come up against. For example, when visiting a village, an outsider will see the people as a group, some of their work activities and the general layout of the village. There is much more that he will not see or comprehend, such as their traditions, their beliefs, the social structure, their attitudes, relative values, family and leadership roles - all of which have bearing on whether they are ready or willing to accept new concepts unfamiliar and untried.

In looking back, we can see some of the reasons why certain programs have been highly successful while others have faltered, or at least have gotten off to a slow start.

First, here are several of the common problems.

Since much of the support for educational programs has been through USAID, one limitation has been the method of financing - on a year to year basis. One AID official expressed it, "We are trying to do a 20-year job with 2-year staff members and 1-year appropriations."

Another problem has sometimes resulted from the people of this country who were selected for the various assignments. Frequently, contracts that were under negotiations for months were finally approved, and it was expected that the people would be provided almost immediately thereafter. Those selected were not given adequate preparation for their new assignments. They did not get the proper concept of the culture and actual needs of the country to which they were going. Some expected to work in a rather narrow area of their speciality, whereas what was actually needed was a much broader approach.

There have been some real problems that can be contributed to the host country's side. Too often when the advisor arrived at his post, he did not have a suitable counterpart. In other cases, when an outstanding individual was his counterpart, by the time he got the person trained and ready to take over, the host government assigned its representative to another job.

Getting across the idea that an agricultural college or university should include resident teaching, research and extension was another real

barrier in many instances. Where agricultural colleges already existed in the country, the research and extension was frequently under the Ministry of Agriculture, which had no connection with the college. It sometimes proved an almost insurmountable problem getting the three functions of teaching, research and extension under one administrative unit.

Many of the older educational institutions in parts of the world were set up under the European system, especially patterned after those of the British. In these institutions they used the external examinations. Under this system, a student's passing or failing a course depended entirely on one examination made up by some individual or a committee other than the person teaching the course. The teacher giving the lectures would stick close to a pattern of material that he thought would give the student enough information to pass the course. Often the student had little or no interest in the day to day lectures. His interest was to cram enough facts so as to pass the examination and that was it. When some of our people tried to introduce our system of education where the instructor handling the course also gives the examinations and assigns the students' grades, there was considerable opposition to overcome.

In many institutions, library books were not only scarce and possibly out of date, but were also kept under lock and key so that they were not accessible to the students. There is still a long way to go in building what we consider suitable libraries at these institutions managed in such a way that the students have ready access to

to the books. But progress is being made.

These have been just a few of the problems that have been confronted by those on overseas assignments. Now I would like to trace the progress of agricultural university development in India where there have been outstanding successes along with many problem areas.

The first official agreement covering a United States sponsored university contract was signed in 1952. During the next twenty years, six American universities became involved, namely the University of Illinois, Kansas State University, University of Missouri, Ohio State University, Pennsylvania State University, and the University of Tennessee. During this time, more than 300 United States staff members representing over 700 man-years were involved, and over 1000 Indian faculty members and graduate students studied in the United States. By 1972, India had established nine new agricultural universities patterned to quite an extend after our land-grant institutions. This program was phased out during 1972 and 1973 at the request of the government of India.

At the time of India's independence from the British Colonial Empire in 1947, over 80 percent of the people lived in more than 500,000 villages where farming was a primary occupation. Still, the farmers were not producing enough food for the nation's people at even their low level of consumption. At that time, the entire country had only 21 universities. The graduates of these were in fields entirely unrelated to agriculture and to the needs of the rural people. Recognizing this,

the Government of India in November, 1948 set up a University Education Commission whose mandate was to review the current status of university education in the country and make recommendations for changes and improvements to better the needs of all the people. One of the primary recommendations of this Commission was to establish a number of rural universities and offered guidelines which would pattern them after our land-grant system.

During the following years, some small colleges of agriculture and colleges of veterinary medicine were set up with teaching being their only role. Often they were poorly staffed and inadequately financed. Whatever research and extension existed was under a Ministry of Agriculture with no connection with the college.

In 1952, the United States signed the first agreement with India to provide technical assistance in agriculture. The same year the United States Technical Cooperation Administration (TCA) requested the University of Illinois to assist in improving one of its agricultural colleges, the Allahabad Agricultural Institute. Through the efforts of several dedicated people on the Illinois team, a great deal of progress was made at Allahabad, and this led to a demand for further assistance from American universities.

In 1954, India and the United States signed an agreement covering assistance to agricultural research, education and extension organizations. The agreement provided funds for a joint Indo-American team to study the organization, functions and operations of Indian and American education

and research institutions. The final outcome was a decision to divide India into five regions with an American university working with the agricultural and the veterinary colleges in each region. The five universities that signed University-AID contracts in 1955 were the University of Illinois, Kansas State University, University of Missouri, Ohio State University, and the University of Tennessee with each being responsible for one of the regions. Each university soon had a team in the field, but various problems became evident with this arrangement. These included too few Americans spread over too many institutions over a wide area; major differences of opinion among the members of the partnership as to what should be done; and contracts that basically called for (1) university staff members to serve as agricultural advisors, (2) Indian staff members to be sent to the United States for study and (3) Indian institutions to receive equipment and reference materials. At some of the institutions, the administrators and faculty members were very much interested in receiving the equipment and books and in coming to our country for further study. However, they were often not certain as to how they would use the American advisors. In some instances, when the American advisor arrived in India, he found that there was no Indian counterpart to work with him. Sometimes the Indian counterpart looked upon the advisor as a threat to his own professional security. At times a very satisfactory relationship was worked out between the advisor and his counterpart, but then the counterpart was shifted to another assignment. A person who had enjoyed considerable freedom on

his own campus here in this country experienced in India a great deal of restriction due to numerous regulations and red tape. Since his assignment was usually for two, or at most four years, there was an urge to get going on things that needed to be done, but he often became frustrated at seemingly needless delays.

In spite of the above problems, progress did take place through the efforts of individual American and Indian educators. But, it became evident that there should be a change in emphasis, and various proposals were considered for a long range program. The policy statement finally agreed upon was that the overall objective of the United States university contract programs was to help India develop complete state agricultural universities with colleges of agriculture, veterinary medicine, agricultural engineering, home science, and basic sciences and humanities. This objective implied assistance in the development of coordinated programs of resident instruction, research and extension education within the university structure.

New contracts were signed in 1964 with the five American universities and the program was renamed the Agricultural University Development Project. The Pennsylvania State University became the sixth university in 1967 with a contract for a team in the State of Maharashtra.

The new policy spelled out the following conditions for a state to qualify for USAID-University support:

(1) Legislation acceptable to the Agricultural University Development Project Committee, either passed or with reasonable assurance of being passed.

(2) Government of India and state assurance that funds would be available for building, staffing and other needs.

(3) Assurance that the new university could provide adequate technical and administrative staff.

(4) Assurance that the Government of India would approve the kind and amount of U.S. technical assistance considered necessary by the cooperating U.S. and Indian universities.

It was in the above framework that six U.S. land-grant universities helped establish agricultural universities in nine Indian states during the decade that followed. Several can now be considered as outstanding institutions which might serve as models for others within India or other countries in that part of the world.

Now, to give you an insight as to how we went about establishing a College of Agricultural Engineering within the University in the State of Maharashtra. This is probably quite typical of what other advisors went through in helping to establish colleges within their assigned universities.

We had to take into account the existing situation. There were already nine separate colleges of agriculture and two colleges of veterinary medicine within the state, each autonomous. There were also 81 separate experiment stations under the Ministry of Agriculture. Most of these were very small and often manned by just one person. These were to be brought into one university system. The decision needed to be made by the State as to where the headquarters for this

university would be located. It could either be at one of the existing colleges or at a new location. When we inquired as to what the plans were, the usual answer was, "That is a political decision."

Finally, through much political maneuvering, a location was selected in the western part of the State which was semi-arid and near a small village. However, a reservoir was under construction nearby, so there were future prospects of irrigation for the area. It was decided to take over 16,000 acres of land for the agricultural university. This meant displacing about 1500 farm families, and naturally there was a great deal of resentment. However, it was finally accomplished.

The administration of the University placed the College of Agricultural Engineering as one of its highest priorities. It did not even wait until the facilities would be built at the new university site. Instead, a group of 20 students were selected as a start for this College, and they began their studies at the city of Poona where one of the nine agricultural colleges already existed. This college was not in a position to give them the necessary training towards a program in agricultural engineering. Consequently, these students were farmed out to three different institutions in the area during their first three years. They received some of the basic engineering courses at a traditional engineering college, and they obtained the more applied courses at a three-year technical school and their agricultural courses at the college that was associated with the University.

From the start we insisted that the program include a great deal of applied training.

We outlined a proposed curriculum extending over a five-year period, and then checked with a number of potential employers to see whether they thought the graduates from such a program would have a place in their organizations. We met with considerable interest from these potential employers. The program included not only the basic mathematics, science and engineering along with the applications to be included in agricultural engineering courses, but it also included a requirement of a certain number of hours of work during the week while in school plus summer employment in industry.

The first group completed the five-year program a year ago and the report from the person in charge is that all have been placed. Some have gone into government jobs, some into industry and a few have gone on for graduate work either in India or here in the States. This is in face of the fact that a high percentage of university graduates in India are unemployed. I believe that the key to their success is that these people had in their program a sufficient amount of the applied practice to make them employable upon graduation.

In assisting this program, the next step was to develop plans for a building to be used by the College of Agricultural Engineering. The way the law was set up, the only degree granting program in engineering was to be agricultural engineering. However, it was recognized that even though the degrees were initially only in this field, there was a need to set up departments of civil, mechanical and electrical engineering to teach the service courses. Also, looking ahead, it was

realized that soon these other departments would want to have their own majors and to grant degrees in these other areas. This had to be taken into account in setting up the facilities.

I found this to be a most satisfying experience. We received the go ahead from the Vice-Chancellor (President) of the Institution with the only requirements being to plan whatever facilities were needed and to be the best in India. There was no established price tag. I have been involved in planning several university buildings, but this was the first time that there was no limit on the cost. Also, I had the opportunity of working with an outstanding architectural firm in New Delhi. An important part of the overall plan for this facility was an area of 50 acres behind the building and adjacent to a canal that was under construction. The intent was that crops could be planted in this area at different times of the year and the students would gain experience in actually carrying out the various field operations involved. It was also anticipated that this would make an excellent site for an outdoor hydraulics laboratory.

While we were involved in developing the plans for these facilities, the University Administration assured us that these would get the highest priority from the standpoint of construction. Before leaving there in April, 1971, we had the plans finalized and they were approved by the Vice-Chancellor. Construction was to begin as soon as the detailed specifications were written and contractors' bids received. That was very encouraging. But, a few weeks later, there were student uprisings

and demonstrations at the Institution for some of their alleged grievances and soon the Vice-Chancellor and other top officials were fired. For some months thereafter, the Institution was under an acting Vice-Chancellor, so the building plans were laid aside. Then, a new Vice-Chancellor came in who placed his top priority elsewhere. This was followed by a war and various financial problems. The result is that those plans and our good intentions are still in the architect's office and there is no permanent building for the College of Agricultural Engineering. However, as an interim we did get some temporary buildings set up on the new campus, and the agricultural engineering students from the first group moved there during their fourth and fifth years. From reports received, they are continuing to take in about 20 students each year and there is now a going agricultural engineering program at this Institution.

I feel strongly that for many of the countries the proper program for engineering students is (in addition to getting the basics in mathematics, science and engineering) one in which there should be adequate provision for much applied work. It is not out of line to have a program leading to the B.S. degree that extends over five or even six years. I also believe that the institutions in most of these countries should concentrate at the present on only the B.S. degree program. There is a place for few to offer advanced degrees and there is also a recognized need to send some of the more outstanding students to other countries for graduate work. There is a danger, however, of getting too many over-educated for the immediate needs in their own

country, which only leads to them being unemployable and frustration on their part. We have seen too many cases where these people had good intentions of going home to serve their country, but after a period of time without a job have gone elsewhere. Too often, higher degrees become status symbols for both students and the institutions. I believe that we should resist this trend and concentrate on training students for jobs that need to be done in their own industries and in some of the applied government services at whatever level employment opportunities exist.